



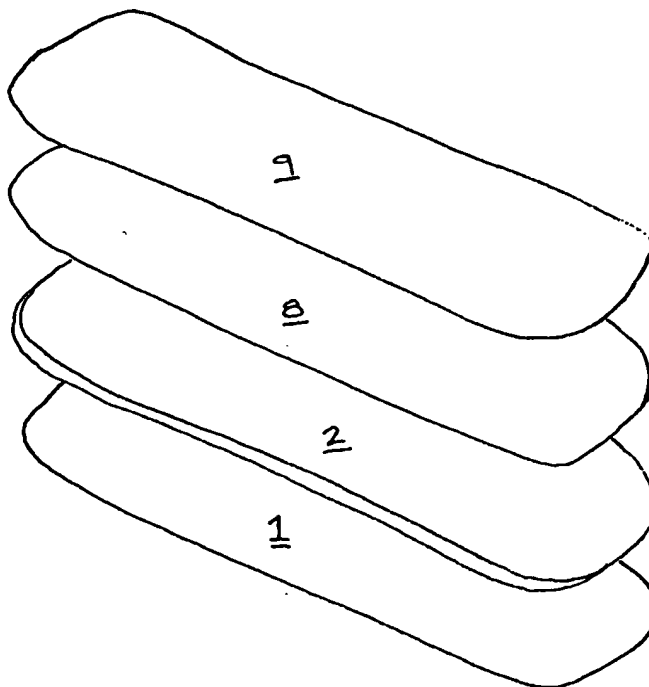
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: **HEAT-ACTIVATED ADHESIVES**

## (57) Abstract

The present invention is directed to body-activated adhesives having adhesive properties, which increase with exposure to temperature and humidity conditions approximating the temperature and humidity proximate to the human body, particularly the temperature and humidity of the crotch. The novel adhesive compositions are useful as adhesive coatings or layers in various personal care products, particularly pantliners. The adhesive compositions of the present invention are especially useful in personal care products, such as pantliners. The present invention is also directed to pantliners containing the adhesive compositions, which can be manufactured without a peel strip.



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## HEAT-ACTIVATED ADHESIVES

## FIELD OF THE INVENTION

10           The present invention relates generally to adhesive compositions. The novel adhesive compositions of the present invention are body activated in that the adhesive compositions of the present invention increase in adhesive strength with exposure to the warm and humid environment proximate the human body. Specifically, the adhesive  
15       compositions of the present invention increase in adhesive strength with exposure to temperatures and humidities greater than normal room and storage conditions, about 70°F (or about 20°C) and 50 percent relative humidity. More specifically, the adhesive compositions increase in adhesive strength with exposure to temperatures and humidities greater  
20       than 80°F (or about 26°C) and 70 percent relative humidity.

## BACKGROUND OF THE INVENTION

          Residents of industrialized countries consume large quantities of materials. Much of the consumed materials is disposable and is discarded.  
25       The discarded materials are collected and sent to a landfill. As the number of industrialized countries increases and the population increases, the quantity of material consumed and eventually disposed of in landfills is expected to increase. Thus, it would be desirable to decrease the amount of material accumulating in landfills.

30           In the United States, the accumulation of municipal waste in landfills per person per year consists of approximately: 265 kilograms (hereinafter kg) paper and cardboard, 70 kg plastics, 65 kg metals, and 270 kg of various other materials. Contrary to popular belief, paper,

although degradable, degrades slowly in a landfill environment. Headlines of newspapers can be legible after twenty-five years of burial in a landfill. Plastics, though making up a smaller percentage of accumulated waste material than paper, make up a more visible portion of the accumulated landfill material. Conventional plastics degrade more slowly than paper and are more visible and thus considered offensive. Therefore, it would be desirable to eliminate as much paper and plastic as possible from disposal in landfills.

Feminine protection pads, sanitary napkins and pantliners are disposable, personal care products comprising paper and plastic components. These personal care products are used only once and then disposed. The amount of disposed personal care products will increase as the general population and awareness in personal hygiene increases. Currently, pantliners comprise a body-side liner 1, an absorbent pad 2, an outer cover sheet 3, a hot-melt pressure-sensitive garment attachment adhesive 4 and a release strip 5 as illustrated in Figure 1. A consumer removes the release strip 5 from the pantliner to expose the underlying garment attachment adhesive. The underlying garment attachment adhesive is then used to adhere the pantliner to the crotch of the consumer's undergarment. After the release strip 5 is removed, the release strip 5 is discarded in a trash receptacle and eventually disposed of in a landfill.

The conventional release strip 5 is a paper strip with a silicone-based release coating. The silicone-based coating is used to ensure that the release strip 5 easily peels away from the pantliner without removing any of the underlying adhesive 4 from the pantliner. Unfortunately, the silicone-based coating on the paper release strip 5 increases the water resistance of the paper release strip 5 and also decreases the degradability of the paper release strip 5. If flushed in a toilet, a conventional release strip 5 is not likely to break up in the toilet or the attached drain line and is likely to cause clogging somewhere in the sewage system. If the release strip 5 does not clog the sewage transport system and makes it to the sewage system, it will likely end up being collected on sewage treatment

plant bar screens. It would be desirable, both economically and environmentally, to eliminate release strips, especially silicone-coated paper release strips. Furthermore, it would be desirable to provide a pantiliner not requiring a release strip.

5           Therefore, there is a need to provide adhesives not requiring the use of release strips.

#### SUMMARY OF THE INVENTION

10           The present invention provides novel adhesive compositions and films and articles incorporating the novel adhesive compositions. The novel adhesive compositions of the present invention are body activated in that the adhesive compositions increase in adhesive strength with exposure to the warm and humid environment proximate the human body. More particularly, the adhesive compositions of the present invention have the  
15           unique property of increasing in adhesive strength after exposure to temperatures greater than about 70°F (or about 20°C) and relative humidities greater than about 50 percent. Even more particularly, the adhesive compositions of the present invention increase in adhesive strength with exposure to temperatures greater than about 80°F (or about  
20           25°C) and relative humidities greater than about 70 percent.

          Advantageously, the adhesive compositions of the present invention have low initial tack at typical room and storage conditions. Thus, the adhesive compositions can be used to manufacture articles incorporating adhesive layers and coatings without necessarily including  
25           protective coatings, strips or packaging that are normally included to protect the adhesive layers and coatings. The novel adhesive compositions of the present invention are especially useful as adhesive layers and coatings in personal care articles. In one illustrative application, the personal care article incorporating the body-activated adhesive  
30           compositions of the present invention is a pantiliner. The novel adhesives of the present invention allow the deletion of expensive, silicone-based peel paper strips and hot-melt, pressure-sensitive garment adhesives used in conventional pantliners. A pantiliner, which incorporates the adhesive

compositions of the present invention. does not require a silicone-based peel paper strip, and eliminates, or at least minimizes, the amount of hot-melt, pressure-sensitive garment adhesive is described herein.

5 The films, coatings and articles incorporating films and coatings of the adhesive compositions of the present invention build adhesion to undergarment fabrics, particularly cotton, with exposure to warm and humid conditions approximating the environment proximate the human body, particularly the warm and humid environment of a human crotch. Because films and coatings of the novel adhesive compositions have low  
10 initial tack, articles incorporating these adhesive films and coatings do not require a peel strip.

#### BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is an exploded view of the components of a prior art  
15 pantiliner illustrating the layering sequence of a conventional pantiliner.

Figure 2 is an exploded view of the components of a pantiliner in accordance with one embodiment of the present invention described in Example 4.

Figure 3 is an enlarged, cross-section view of a pantiliner folded  
20 in a bifold relationship with the body-activated adhesive facing inward.

Figure 4 is an exploded view of the components of a pantiliner of Figure 2 and Example 4 further including conventional garment attachment adhesive.

#### 25 DETAILED DESCRIPTION OF THE INVENTION

Applicants have developed novel adhesive compositions that possess unique and unexpected properties. The novel adhesive compositions of the present invention possess the unique and unexpected property of increasing in adhesive strength to cotton fabric when exposed  
30 to elevated temperature and humidity, particularly elevated temperature and humidity conditions approximating the temperature and humidity next to a mammal's skin and body. More particularly, the novel adhesives of

the present invention increase in adhesive strength when exposed to the temperature and humidity proximate a human's skin.

5 The adhesive compositions of the present invention have particular utility in adhering articles where such conditions may be encountered. These adhesive compositions may be useful for manufacturing or adhering various products, particularly personal care articles, and more particularly pantliners. Other suggested articles include: sanitary napkins, feminine pads, diapers, incontinence devices, bandages, wound dressings, shoe inserts, etc.

10 Currently, conventional hot-melt adhesives are used to temporarily adhere pantliners to the undergarment of a consumer. Conventional adhesives are tacky at room temperature and require a peel strip to protect the adhesive surface prior to use. The adhesive is used to secure the pantliner to the crotch of the undergarment of the consumer  
15 during normal use. Desirably, the adhesive secures the pantliner in a desired position during use yet allows the pantliner to be easily removed after use. Most desirably, the adhesive peels away with the pantliner upon removal by the consumer and transfers little if any adhesive to the undergarment to which the pantliner was adhered. In order to perform in  
20 this manner, the adhesive should have better cohesion to the pantliner than adhesion to the undergarment fabric. About ninety-five percent of all women's undergarment crotch fabrics are a cotton fabric. Therefore, it would be desirable to develop adhesive compositions that adhere well to cotton fabric during human use conditions, but that are not tacky prior to use. Specifically, it would be desirable to develop adhesives that are not  
25 tacky under storage and room temperature and humidity conditions.

The present invention provides adhesives and pantliners that meet many of the above requirements by utilizing an adhesive composition that possesses beneficial properties. The adhesive  
30 compositions have low initial adhesive strength and develop increasing adhesive strength during exposure to the temperature and humidity conditions encountered in normal pantliner use. Specifically, the adhesive compositions of the present invention are temperature and moisture

sensitive and activatable. exhibiting increasing adhesive strength upon exposure to the warm, humid environment next to human skin. More particularly, the adhesive compositions exhibit increasing adhesive strength upon exposure to warm, humid environments approximating the environment proximate a human body, about 100°F and about 80 percent relative humidity. 37.78°C

Pant liners are designed to absorb small amounts of liquids, usually one milliliter or less of menses and/or urine. To increase the comfort of the wearer, the pant liner should not only absorb the liquids, but also wick the absorbed liquids away from the skin of the wearer. Desirably, a pant liner also prevents the absorbed liquids, menses and/or urine, from soiling the undergarment to which the pant liner is adhered. More desirably, the user should not be able to see the absorbed liquids through the reverse side of the pant liner. Thus, pant liners should have both absorbent and barrier properties.

The present invention provides a novel pant liner incorporating a body activate adhesive composition of the present invention. One such pant liner is illustrated in Figure 2 and described in further detail in Example 4. The novel pant liners take advantage of the beneficial properties of the adhesive compositions of the present invention and also possesses the following advantages. The pant liners comprise a body-activated adhesive that has excellent adhesion to undergarment crotch materials, particularly, cotton, which comprises about 95 percent of all undergarment crotch materials. Although the adhesive has excellent adhesion under moist body-temperature conditions, it is easily peeled away by the wearer after use and leaves no visible adhesive on the undergarment after removal.

In at least one embodiment, the adhesive compositions are water soluble or water dispersible. Thus, the adhesives can be dissolved and removed by laundering with water. More importantly, any adhesive that may remain on a surface to which the adhesive was adhered may be cleaned or laundered with water. Desirably, the adhesive compositions are soluble or dispersible in tap water, but not in human wastes. In at least



one embodiment, the adhesive compositions are resistant to urine and menses, yet are disintegratable or soluble in tap water.

Advantageously, a pantiliner incorporating a body-activated adhesive of the present invention can be folded upon itself in a bifold relationship as illustrated in Figure 3. A folded pantiliner requires a smaller package. It may be desirable to provide at least some conventional pressure-sensitive adhesive 10, as illustrated in Figure 4, to initially adhere the pantiliner, or any other article incorporating the body-activated adhesive, until the body-activated adhesive gains sufficient adhesive strength. It may be desirable to provide folded pantliners with at least one spot of conventional pressure-sensitive adhesive 10 that contacts body-activated adhesive on the opposite folded half until unfolded by a consumer. The conventional pressure-sensitive adhesive may be protected by a small peel strip(s), particularly if the pantiliner is to be packaged in an unfolded relationship.

The novel pantliners, incorporating a body-activated adhesive illustrated in Figures 2 and 4, are based on an absorbent core 2 and incorporate a body-activated adhesive 9. The body-activated adhesive does not necessarily have to be incorporated as a layer or coating as illustrated in Figures 2 and 4 and can be applied in various manners and patterns. For example, the body-activated adhesive may be incorporated in a discontinuous pattern such as the strips illustrated in Figure 1, applied in a melt blown or in a discontinuous printed pattern. The pantliners may include additional layers, for example, a support layer 8 intermediate the adhesive layer 9 and the absorbent core 2. The pantiliner may further comprise additional absorbent layers, a body-side liner, etc.

The novel adhesive compositions of the invention include adhesives that have low initial tack and adhesive strength, but increase in adhesive strength with exposure to warm, humid environments. Such adhesives are referred to herein as body-activated adhesives. These body-activated adhesives include polymers and copolymers of ethylene oxide, desirably graft copolymers of poly(ethylene oxide). Desirable graft copolymers of poly(ethylene oxide) and methods of making these graft

copolymers of poly(ethylene oxide) are disclosed in copending U.S. Application Nos. 09/001,408, 09/001,831 and 09/002,197, the disclosures of which are incorporated herein by reference in their entirety. Based on the results in Examples 1, 2 and 3 herein, it is anticipated that grafted and ungrafted poly(ethylene oxide) compositions (hereinafter PEO) will provide the desired body-activated adhesive properties. For example, ungrafted PEO resins, such as POLYOX® WSR N-750 and POLYOX® WSR N-80, may be used to replace the grafted PEO in Examples 1, 2 and 3. Similarly, other grafting monomers could be substituted as suggested in the above-referenced patent applications.

Additional body-activated adhesive compositions may include the polyesters described in U.S. Patent Nos. 5,543,488, 5,552,495, 5,709,940 and 5,718,790, the disclosures of which are incorporated herein by reference in their entirety. Commercial examples of these polyesters can be obtained from Eastman Chemical Company of Kingsport, Tennessee and include Eastman resins AQ 1350 and AQ 1950. Other examples of body-activated adhesive polyesters include the water-sensitive sulfonated polyesters described in European Patent Application EP 0 761 795 A2, the disclosure of which is also incorporated herein by reference in its entirety. One commercial example of a sulfonated polyester with body activated adhesive properties was obtained from National Starch and Chemical Company of Wilmington, Delaware and was provided as National Starch resin 70-4395.

The body-activated adhesive compositions of the present invention may also comprise various additives. Desirably, the PEO containing body-activated adhesive compositions of the present invention comprise cohesive agents and tackifier resins. The adhesive compositions of the present invention may also comprise antioxidants, UV stabilizers, colorants, fillers, and other known additives for adhesive compositions. Desirably, the PEO based adhesive compositions of the present invention comprise about 10 to about 60 weight percent elastomeric cohesive agent, more desirable about 10 to about 30 weight percent. The cohesive agent should be elastomeric to give additional cohesive strength. Additionally, it

*Carbowax*

is desirable that the elastomeric cohesive agent is thermoplastic so that it can be easily melt blended into the adhesive compositions. In general, the melt flow rate of the cohesive agent should be greater than 0.2 grams per 10 minutes and less than 20 grams per 10 minutes based on ASTM standard D1238. Suitable cohesive agents include, but are not limited to, ethylene/vinyl acetate copolymers such as the LEVAPRIN® 600 ethylene/vinyl acetate copolymer employed in Examples 1, 2 and 3. LEVAPRIN® 600 ethylene/vinyl acetate copolymer has a melt flow rate of less than about 5 grams per 10 minutes at 190°C. Desirable ethylene/vinyl acetate copolymers include ethylene/vinyl acetate copolymers with a vinyl acetate contents ranging from about 20 to 100 percent vinyl acetate and include VINAC® B-100 vinyl acetate homopolymer, acid-modified EVA resins such as BYNEL® resins and ethylene/acrylic or methacrylic acid copolymer resins such as NUCREL® from DuPont. In addition, other thermoplastic elastomers, such as KRATON 1107 available from Shell Chemical Company and the like, may be suitable cohesive agents.

Additionally, a wide variety of tackifier resins may be incorporated into the body-activated adhesive compositions of the present invention. Suitable tackifier resins include, but are not limited to, FORAL® 85, a slightly polar rosin ester tackifier resin employed in Example 1 and PICCOTEX® 75, a vinyl toluene-co-alpha methyl styrene copolymer employed in Example 2. Any tackifier resin that provides the proper level of adhesion under body-wear conditions, but does not generate appreciable tackiness under normal storage, is suitable. Other suggested tackifier resins include other rosin esters, aromatic esters and terpene phenol resins.

The body-activated adhesive films described herein have excellent adhesion to cotton undergarment crotch materials under moist body-temperature conditions. Adhesive films and coatings comprising the compositions described herein eliminate the need for peel paper strips and also eliminate or minimize the need for conventional garment attachment adhesives. This unexpected advantage of the body-activated adhesive

compositions described herein allows a reduction in the cost and the number of materials required to manufacture personal care articles, including sanitary napkins and pantliners.

Other features and advantages of the present invention will become apparent after a review of the above Detailed Description and the following disclosure of four exemplary embodiments of body-activated adhesive compositions in Examples 1 through 4 below.

#### EXAMPLE 1 – Body-activated Adhesive Composition

The body-activated adhesive composition of Example 1 was prepared from a melt blend of the following three components in the following proportions: 70 weight percent of a poly(ethylene oxide) (hereinafter PEO) graft copolymer; 10 weight percent of ethylene/vinyl acetate copolymer; and 20 weight percent of rosin ester tackifier resin. The PEO graft copolymer that was used in this and the following examples was produced by the reactive extrusion of: 14.8 pounds of POLYOX® 205 PEO resin; 1.5 weight percent of 2-hydroxyethyl methacrylate (hereinafter HEMA) monomer, relative to the weight of the PEO resin; 0.15 weight percent LUPERSOL® 101 free radical peroxide initiator; and 0.2 pounds of titanium dioxide pigment. The base PEO resin used to produce the PEO graft copolymer was POLYOX® 205, a commercially available polymer of ethylene oxide with a reported average molecular weight of 600,000 grams per mole. Various molecular weights of PEO resins can be obtained from Union Carbide Corporation and are sold under the trademark POLYOX®. LUPERSOL® 101 is a free radical initiator comprising 2,5-dimethyl-2,5-di(t-butylperoxy) hexane and is commercially available from Elf Atochem North America, Inc. of Philadelphia, PA. The free radical initiator is used to initiate sites on the PEO for grafting the HEMA monomer onto the PEO. PEO graft copolymers and methods of making these PEO graft copolymers are disclosed in copending U.S. Application Nos. 09/001,408, 09/001,831 and 09/002,197. Compositions comprising these PEO graft copolymers are useful as body-activated adhesives. The HEMA-grafted-PEO also

contained the following stabilizing agents: 1000 parts per million (hereinafter ppm) of IRGANOX® 1010 and IRGANOX® 1076, and 2000 ppm IRGANOX® 168.

5       The ethylene/vinyl acetate copolymer of the blend was a copolymer of 60 percent vinyl acetate and 40 percent ethylene that is commercially available from Bayer Corporation under the trademark LEVAPRIN® 600. The rosin ester tackifier resin component of the blend was obtained from Hercules Corporation and is sold under the trademark FORAL® 85. The above components were melt blended in a HAAKE  
10   TW-100 twin-screw extruder with an intensive mixing screw at a temperature of 180°C through a strand die in order to produce the body-activated adhesive formulation of Example 1. The extruded formulation was cooled and then pelletized. The resulting pellets were remelted in the HAAKE TW-100 twin-screw extruder at 180°C and extruded through a  
15   film die onto a 2 mil MYLAR® polyester film. The coating thickness of the body-activated adhesive on the 2 mil MYLAR® polyester film was also 2 mils. The resulting "tape" formed from the MYLAR® polyester film and body-activated adhesive coating was used to test the adhesive properties of the body-activated adhesive composition, the results of which  
20   are reported in Table 1 below. All of the tapes produced in this example and the following examples were not tacky at room temperature and did not require a release liner to wind into rolls.

### EXAMPLE 2 – Body-Activated Adhesive Composition

The body-activated adhesive composition and tapes of Example 2 were prepared in the same manner as described in Example 1 above, except that the body-activated adhesive composition of Example 2 was prepared from a melt blend of the following three components in the following proportions: 76.7 weight percent of the aforementioned HEMA-grafted-PEO; 16.7 weight percent of LEVAPRIN® 600; and 6.6 weight percent of PICCOTEX® 75, a vinyl toluene-co-alpha methyl styrene copolymer, available from Hercules Corporation.

### EXAMPLE 3 – Body-Activated Adhesive Composition

The body-activated adhesive composition and tapes of Example 3 were prepared in the same manner as described in Examples 1 above, except that the body-activated adhesive composition of Example 3 was prepared from a melt blend of only two components, the PEO component and the cohesive agent component. The two components of Example 3 were melt blended in the following proportions, 90 weight percent of aforementioned HEMA-grafted-PEO and 10 weight percent of LEVAPRIN® 600 ethylene/vinyl acetate copolymer. Example 3 in addition to illustrating another exemplary body-activated adhesive formulation also demonstrates the optionality of the tackifier component in the body-activated adhesive compositions of the present invention.

### Peel Adhesion of Examples 1-3 From Cotton Cloth After Exposure to Conditions Simulating the Human Crotch Environment

To simulate the adhesion of a pantliner incorporating an adhesive layer of the body-activated adhesive compositions to the cotton crotch of an undergarment, tapes of each of three examples were cut to a one-inch width and applied to standardized cotton fabric. Each tape/fabric sample was then placed on a metal plate perforated with 7-millimeter diameter holes spaced 10 millimeters apart, center to center, and exposed to humid air approximating human crotch conditions. A brass block 2.4375 inches wide by 4.75 inches long by 1 inch high and weighing 1600

grams was placed on top of the tape/fabric sample to supply a pressure load of approximately 0.3 pounds per square inch to the tape/fabric sample.

Five tape/fabric samples of each example were placed under the 0.3 psi load and conditioned at 100°F and 80 percent relative humidity for 15, 60 and 180 minutes. The tape/fabric samples were tested immediately after each exposure period on a Sintech tensile tester in the "T-peel" mode at a crosshead speed of 20 inches per minute. The average peel adhesion was recorded for each of the five tape/fabric samples at each of the three exposures for each of the examples. The average peel adhesion for each of the exposure periods and examples was calculated and is reported in Table 1 below.

**TABLE 1**  
**PEEL ADHESION TO COTTON FABRIC**

Conditioning Time (min)	Example 1 (grams/inch)	Example 2 (grams/inch)	Example 3 (grams/inch)
15	63	14	11
60	73	89	17
180	156	100	49

The data presented in Table 1 demonstrate a distinguishing feature of adhesive compositions of the present invention, and films, coatings, articles, etc. comprising the adhesive compositions of the present invention. The adhesive compositions and films, coatings, articles, etc. incorporating the adhesive compositions described herein are body activated. That is, the adhesive compositions increases in adhesive strength with increasing exposure to the temperature and humidity conditions approximating the conditions next to human skin. Specifically, the adhesion of the adhesive films and tapes to cotton fabric builds at body temperature, about 100°F, and humidity, about 80 percent relative humidity.

Self Peel Adhesion of Examples 1 and 2 Without Body Humidity Exposure

To demonstrate the low initial tack, adhesive strength, and the suitability of the body-activated adhesive compositions to be employed without release strips, the compositions of Examples 1 and 2 were tested under conditions approximate to normal room conditions. The tests were conducted as follows. A tape was constructed as described in Examples 1 and 2 above. Each of the tapes was then folded in half on itself with the adhesive surface of one folded half contacting the adhesive surface of the opposite folded half. The brass block used in the previous test procedure was placed on top of the folded tape to simulate possible compressive forces encountered in packaging. After three days of exposure at room temperature and humidity, approximately 70 °F and 50 percent relative humidity, the brass block was removed. After the three days exposure under 0.3 psi load at room conditions, the tapes of Examples 1 and 2 unfolded readily and no adhesive attachment was found. These results indicate the potential of utilizing the body-activated adhesives of the present invention for manufacturing and packaging pantliners and other articles without release strips and additional single use packaging. Thus, articles substituting the adhesive compositions of the present invention for conventional adhesives can be manufactured without release strips at reduced material, manufacturing and environmental costs.

EXAMPLE 4 – Pantiliner comprising a layer of body-activated adhesive having optional barrier properties

To produce the pantliners of Example 4, laminates were assembled from four components in the sequence illustrated in Figure 2 and as described in detail below. The pantliners were assembled by laminating a body-side liner 1 to an absorbent core 2. The absorbent core 2 was a coform absorbent core formed from a 120 grams/square meter basis weight of a mixture of 60 percent by weight of wood fluff pulp and 40 percent by weight of a meltblown polymer. The meltblown polymer used in Example 4 was a polyamide obtained from H.B. Fuller Company



under the trade designation NP-2068. The body-side liner 1 consisted of a bonded, carded web containing bicomponent polylactide fibers. Bicomponent polylactide fibers and methods of making the bicomponent polylactide fibers are disclosed in U.S. Patent No. 5,698,322, the disclosure of which is incorporated herein by reference in its entirety.

To the absorbent core side of the body-side liner 1 and absorbent core 2 laminate, a baffle film comprising a support layer 8 coated on one surface with a body-activated adhesive layer 9 was laminated. The baffle film was laminated to the absorbent core 2 with the body-activated adhesive coating side facing outward. The baffle film was formed by coating a body-activated adhesive on one side of a support layer 8. The support layer 8 was constructed from a 1.1 mil thick monolayer film consisting of a water-dispersible blend of a PEO, a poly[ethylene-co-(acrylic acid)], and a plasticizer in the weight ratios of 80/15/5, respectively. The PEO of Example 4 was obtained from Union Carbide and is sold under the trade designation POLYOX® WSR N-80. The poly[ethylene-co-(acrylic acid)] was obtained from Dow Chemical Company and is sold under the trade designation PRIMACOR® 1410. The plasticizer of the Example 4 is a fatty acid amide plasticizer and is sold under the trade designation TWEEN® 20. The body-activated adhesive layer 9 employed in Example 4 was formed by coating a layer ranging in thickness of from about 0.5 mil to 2.0 mil of a sulfonated copolyester blend onto the support layer 8. The sulfonated copolyester of Example 4 was provided by National Starch and Chemical Company under the trade designation 70-4395

Although, the adhesive compositions of this and the preceding examples were applied as a continuous layer, it is understood that the body-activated adhesives of the present invention may be applied in other manners and patterns. For example, the adhesives may be applied in other known manners and patterns, including any discontinuous pattern such as stripes of adhesive as illustrated in Figure 1, a swirl spray pattern, a meltblown process, a discontinuous printed pattern, etc.

The peel adhesion strengths of the adhesive layer and accompanying pantiliner of Example 4 to both cotton and nylon fabrics were tested after varying times of exposure in a controlled force-draft oven set at 37°C and 80 percent relative humidity. The results of the peel adhesion strength tests of the pantliners incorporating the body-activated adhesive composition of Example 4 are presented in Table 2 below.

**TABLE 2**

PEEL ADHESION STRENGTHS OF PANTLINERS COMPRISING THE BODY-ACTIVATED ADHESIVE COMPOSITIONS OF EXAMPLE 4 TO COTTON AND NYLON UNDERGARMENT FABRICS

Exposure Time (minutes)	Peel Adhesion to Cotton Fabric (grams per inch)	Peel Adhesion to Nylon Fabric (grams per inch)
15	8	-
60	111	-
120	193	-
360	194	6

A pantiliner in accordance with the above detailed Example 4 was worn by a female subject for a period of eight hours. Some delamination of the pad was noted on removal. Thus, good adhesion to cotton undergarment fabric was achieved but exceeded the pad cohesion strength. However, delamination of the pantiliner may be prevented by either (1) increasing the cohesion strength of the pad to the adhesive, barrier film or (2) decreasing the adhesion strength of the layer to the undergarment fabric. By increasing the lamination adhesion above the adhesion of the body-activated adhesive to the undergarment, complete removal of the adhesive and pantiliner from the undergarment after use is ensured.

The present invention has been illustrated in great detail by the above specific Examples. It is to be understood that these Examples are illustrative embodiments and that this invention is not to be limited by any

of the Examples or the Detailed Description. Those skilled in the art will recognize that the present invention is capable of many modifications and variations without departing from the scope of the invention. Accordingly, the Detailed Description and Examples are meant to be  
5 illustrative and are not meant to limit in any manner the scope of the invention as set forth in the appended claims.

## CLAIMS

We claim:

- 5           1.       A body-activated adhesive composition, wherein the body-activated adhesive composition increases in adhesive strength with exposure to temperature greater than about 70°F and relative humidity greater than about 50 percent.
- 10           2.       The body-activated adhesive composition of Claim 1, wherein the adhesive composition increases in adhesive strength with exposure to temperature greater than about 80°F and relative humidity greater than about 70 percent.
- 15           3.       The body-activated adhesive composition of Claim 1, wherein the adhesive composition increases in adhesive strength with exposure to temperature within the range of from about 70°F to about 110°F and relative humidity within the range of from about 50 percent to about 100 percent.
- 20           4.       The body-activated adhesive composition of Claim 1, wherein the adhesive composition comprises a polymer of ethylene oxide or a polyester.
- 25           5.       The body-activated adhesive composition of Claim 4, wherein the adhesive composition comprises a graft copolymer of ethylene oxide or a sulfonated copolyester.
- 30           6.       The body-activated adhesive composition of Claim 1, wherein the adhesive composition comprises a polymer of ethylene oxide and a polymer of vinyl acetate.

7. The body-activated adhesive composition of Claim 6, wherein the adhesive composition comprises a polymer of ethylene oxide and a copolymer of vinyl acetate and ethylene.

5 8. The body-activated adhesive composition of Claim 1, wherein the adhesive composition comprises:

a) from about 40 weight percent to about 90 weight percent a graft copolymer of ethylene oxide,

10 b) from about 10 weight percent to about 60 weight percent of a cohesive agent, and

c) from about 0 weight percent to about 50 weight percent of a tackifier resin.

15 9. The body-activated adhesive composition of Claim 1, wherein the adhesive composition comprises:

a) from about 50 weight percent to about 89.5 weight percent a graft copolymer of ethylene oxide;

20 b) from about 10 weight percent to about 30 weight percent of a thermoplastic, elastomeric cohesive agent comprising a polymer or copolymer of vinyl acetate; and

c) from about 0.5 weight percent to about 20 weight percent of a rosin ester tackifier resin.

25 10. The body-activated adhesive composition of Claim 9, wherein the graft copolymer of ethylene oxide is a 2-hydroxyethyl methacrylate grafted copolymer of ethylene oxide.

30 11. The body-activated adhesive composition of Claim 1 wherein the adhesive composition comprises a moisture-sensitive polyester, a moisture-sensitive copolyester, a moisture-sensitive sulfonated polyester or a moisture-sensitive sulfonated copolyester.

12. An article comprising the body-activated adhesive composition of Claim 1.

5 13. A pantiliner comprising the body-activated adhesive of Claim 1 and a second adhesive that is not a body-activated adhesive.

14. The pantiliner of Claim 13, wherein the second adhesive comprises an amount of second adhesive that is less than the amount of body-activated adhesive.

10

15. The body-activated adhesive of Claim 1, wherein the adhesive has increased adhesive strength after 15 minutes of exposure to temperature greater than about 70°F and relative humidity greater than about 50 percent.

15

16. The body-activated adhesive of Claim 1, wherein the adhesive has increased adhesive strength after 60 minutes of exposure to temperature greater than about 70°F and relative humidity greater than about 50 percent.

20

17. A method of adhering an object using the body-activated composition of Claim 6.

25 18. An adhesive composition that increases in adhesive strength to cotton fabric with exposure to a warm and humid environment proximate human skin.

30 19. The adhesive composition of Claim 18, wherein the adhesive composition increases in adhesive strength to cotton or nylon fabric with exposure to a warm and humid environment ranging from about 90°F to about 110°F and greater than about 75 percent relative humidity.

20. A method of adhering an object to a surface comprising:

a) applying an adhesive composition comprising a poly(ethylene oxide) or a sulfonated copolyester to an object,

5 b) contacting the object to a surface, and

c) exposing the poly(ethylene oxide) or the sulfonated copolyester to temperature greater than about 70°F and relative humidity greater than about 50 percent.

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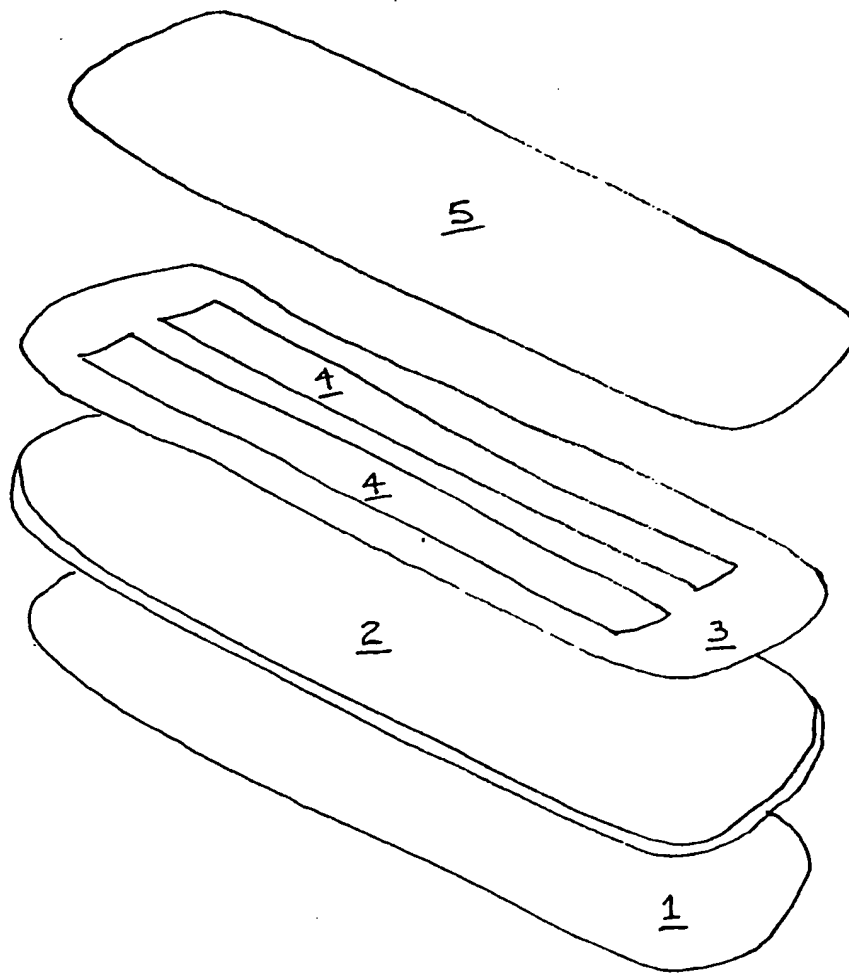


FIGURE 1



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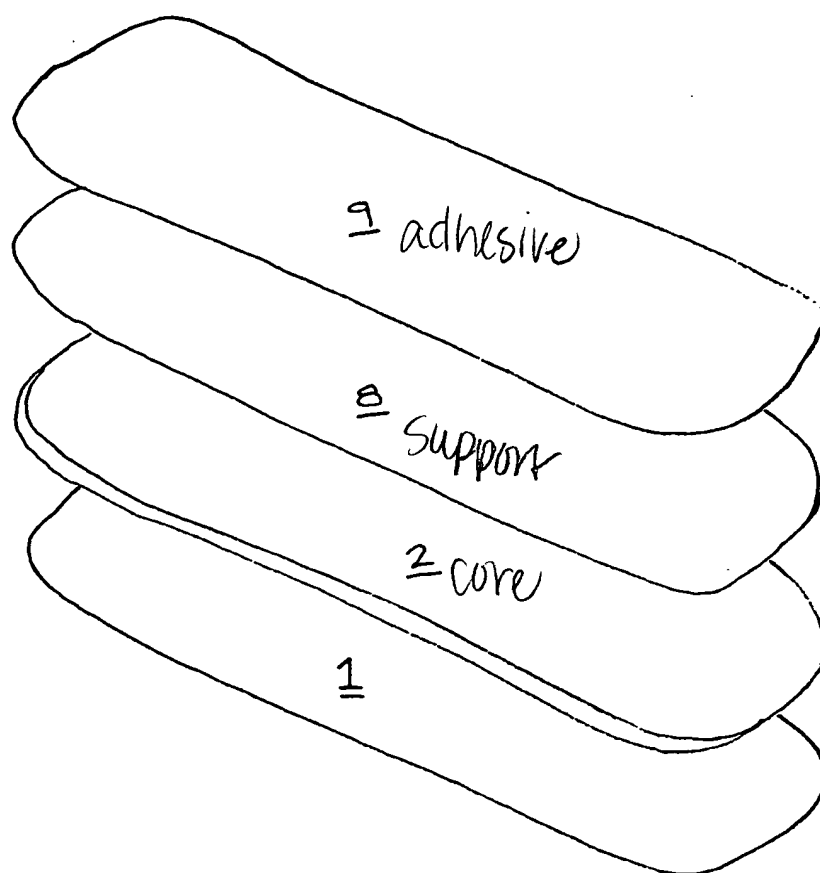


FIGURE 2

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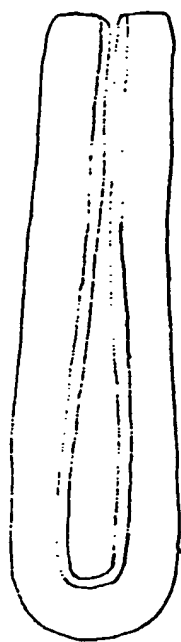


FIGURE 3

4/4

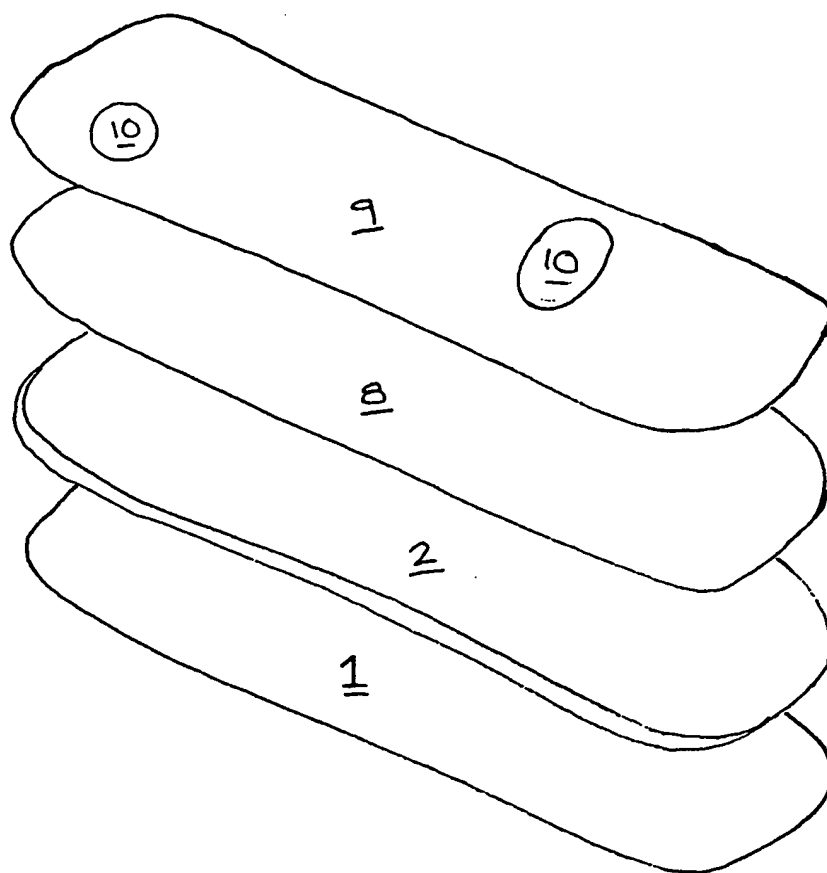


FIGURE 4

# INTERNATIONAL SEARCH REPORT

L. National Application No

PCT/US 99/30590

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A61L15/58

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61F A61L C08F C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 781 538 A (FULLER H B LICENSING FINANC) 2 July 1997 (1997-07-02) tables 1,3 claims	1-5, 11-20
X	WO 98 36117 A (KIMBERLY CLARK CO) 20 August 1998 (1998-08-20) page 9, line 14 -page 10, last line table 1	1-5, 11-20
X	EP 0 761 795 A (NAT STARCH CHEM INVEST) 12 March 1997 (1997-03-12) cited in the application page 9, line 49 - line 54 tables 6,7,9 claims 1-4,8-10	1-5, 11-20
	-/-	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

25 April 2000

Date of mailing of the international search report

04/05/2000

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/30590

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 779 387 A (NAT STARCH CHEM CORP) 18 June 1997 (1997-06-18) tables 1-3 claims 1,2,4,6 ---	1-9,11, 20
X	US 5 660 178 A (RUSTAD NANCY J ET AL) 26 August 1997 (1997-08-26) example 22 claims 8,11 -----	1-10

# INTERNATIONAL SEARCH REPORT

international application No.

PCT/US 99/ 30590

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

## Continuation of Box 1.2

Present claims 1-3,12-16,18,19 relate to a composition defined by reference to a desirable characteristic or property, namely the adhesive composition increases in strength with exposure to temperature >70 C and relative humidity >50%

The claims cover all compositions having this characteristic or property, whereas the application provides support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT for only a very limited number of such compositions. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, the claims also lack clarity (Article 6 PCT). An attempt is made to define the composition by reference to a result to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to the composition mentioned in the description at page 7, line 27 to page 12, line 22 and page 14, line 24 to page 15, line 32.

Present claims 1-3,12-16,18,19 relate to a composition defined (inter alia) by reference to the following parameter - the adhesive composition increases in strength with exposure to temperature >70 C and relative humidity >50%

The use of this parameter in the present context is considered to lead to a lack of clarity within the meaning of Article 6 PCT. It is impossible to compare the parameters the applicant has chosen to employ with what is set out in the prior art. The lack of clarity is such as to render a meaningful complete search impossible. Consequently, the search has been restricted to the parts relating to the composition mentioned in the description at page 7, line 27 to page 12, line 22 and page 14, line 24 to page 15, line 32.

The applicant's attention is drawn to the fact that claims, or parts of the claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

## Continuation of Box I.2

Present claims 1-3,12-16,18,19 relate to a composition defined by reference to a desirable characteristic or property, namely the adhesive composition increases in strength with exposure to temperature >70 C and relative humidity >50%

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Information on patent family members

International Application No

PCT/US 99/30590

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